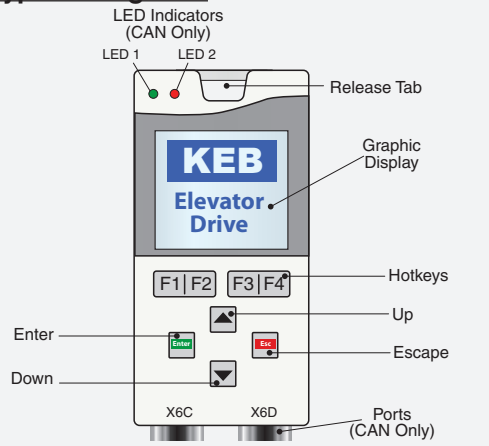
ELEVATOR QUICK-START GUIDE (v 3.00)

Quick-start guide

This guide is intended to be a supplement to the full KEB elevator manual.

Read KEB document#: 00F5LUM-K300 thoroughly before powering up the drive.

Keypad Navigation



LED Indicators (CAN only)

	LED 1	LED 2
Off	No operation (noP) Drive not enabled	
●	Inverter running the motor	**Run Mode** Drive is able to run
● (Blinking)	A limit has been reached (Torque, Current, Voltage)	**Stop Mode** Drive is being programmed or making calculations
● (Solid)		Drive is faulted

Setting the password

The password access level can be set here:
(Home > Prog > Pass (F2))

Higher levels provide access to additional parameters and give the ability to write.

Low access levels will limit the users ability to view and change parameters.

Contact the Controller OEM for more information!

Setting the Date/Time (password limited)

The LCD keypad has a real-time clock & date which can be used to time stamp faults.

The date can be set at *(Home > Prog > Setup > date)*
The date format is mm/dd/yyyy

The time can be set at *(Home > Prog > Setup > time)*
The time format is 24-hour

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Start-up Process

Check Drive Connections
- Power (inc. resistor/regen)
- Control
- Encoder
- Communication

↓

(A) Basic Set-Up
- Units
- Motor/Control Type
- Load Configuration
- Contract Speed

↓

(B) Configure Inputs/Outputs
- PNP/NPN
- Define Inputs
- Define Outputs

↓

(C) Motor Data

↓

(D) Encoder Data

↓

(E) Machine Data

↓

(F) Speed Profile

↓

(G) Motor Learn (Stationary)

↓

(H) Encoder Learn
- SPI (stationary)

OR
- Pole Learn (requires movement)
- Encoder Synchronization

↓

(I) Run the Motor

↓

(J) Advanced Adjustments
- Speed Profile
- Inertia Learn (optional)
- Gains
- Pre-torque (optional)

↓

(K) Special Functions
- Test Function
  - Overspeed Test
  - Safety Release

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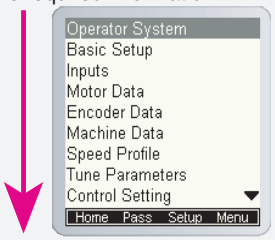
Programming the drive from default

The drive is programmed via the programming menu *(Home > Prog)*

A user should begin at the top of the programming menu and work their way downwards, filling in the required information.



(A) Basic Setup (password limited)

Note: The basic setup might already have been done by the controller mfg.

A1 – Start at the Basic Setup screen *(Home > Prog > Basic Setup)* and confirm/enter the following values based on the application/controller:
- US02 - System Units (Imperial/Metric)
- US03 - Motor Type (i.e. Induction geared or PM synch gearless)
- US04 - Control Type (i.e. Binary, Serial, Analog)

A2 - Load the configuration:
- US05 - Load Configuration *(Write config. to drive)*

If loaded successfully, US05 should change from *Not configured* to *Configuration OK*.

A3 - Enter the contract speed of the application:
- US06 - Contract Speed

If the US02 or US04 parameters are changed after a configuration has been loaded, a new configuration must be written to the drive. Writing a new configuration will NOT default all previous settings.

If the US03 Motor Type must be changed after a configuration has been loaded, a new configuration must be written to the drive and writing the new configuration WILL default all previous settings.

(B) Inputs (password limited)

Note: The basic setup might already have been done by the controller mfg.

B1 - Enter/confirm the type of digital input
- LI01 - Type of Input (PNP or NPN logic)

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Outputs

Note: The basic setup might already have been done by the controller mfg.

B2 - Confirm the correct drive outputs are assigned according to the controller drawing.

The output menu is found at the bottom of the programming screen.

(C) Motor Data

C1 - For induction motors, enter the following parameters from the motor nameplate:
- LM01 - Motor Power (note units)
- LM02 - Motor Speed (RPM) - Verify it is rated "slip speed"
- LM03 - Motor Current
- LM04 - Motor Frequency
- LM05 - Motor Voltage
- LM06 - Motor Power Factor

C2 - For PM motors, enter the following parameters from the motor nameplate:
- LM02 - Motor Speed (RPM)
- LM03 - Motor Current
- LM04 - Motor Frequency
- LM05 - Motor Voltage (EMF rms @ rated speed)
- LM07 - Motor Torque (use lb-ft. for english units; Nm for metric units

⚠ For synchronous motors it is important that the relationship between the motor speed and rated frequency correlate to the number of poles!

$$\text{Motor Speed (RPM)} = \frac{\text{Rated Motor Frequecy (Hz)} * 120}{\text{\# of Motor Poles}}$$

$$\text{LM02} = \frac{\text{LM04} * 120}{\text{\# of Motor Poles}}$$

$$\text{LM04} = \frac{\text{LM02} * \text{\# of Motor Poles}}{120}$$

$$\text{\# of Motor Poles} = \frac{\text{Rated Motor Frequecy (Hz)} * 120}{\text{Motor Speed (RPM)}}$$

Torque units will change depending on which units are set in US02. For reference, here are the equations to convert between Imperial and Metric units provided different nameplate information:

$$\text{lb-ft} = \frac{\text{Nm}}{1.355} = \frac{\text{HP} * 4258}{\text{Rated Motor Speed}} = \frac{\text{kW} * 7051}{\text{Rated Motor Speed}}$$

(D) Encoder Data

D1 – Enter the basic encoder parameters:
- LE02 - Encoder Pulse Number (ppr)
- LE05 - Encoder Multiplier (EnDat = 8; TTL = 2)

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(E) Machine Data

E1 – Enter the machine data:

- LN01 - Sheave Diameter (use inches for english units; mm. for metric units)
- LN02 - Gear Ratio (x:1); gearless applications —> x=1
- LN03 - Roping Ratio (x:1)

Incorrect setting of the machine data parameters may cause the elevator to run too fast or too slow or may incorrectly calculate the overspeed limit.

(F) Speed Profile

F1 – Enter the speed control parameters (digital, binary, and positioning control only).
The speed commands in Analog and Serial speed control are dictated by the controller so these speed parameters will have no effect. However, in Analog speed control, the user must enter a High Speed setting which corresponds high speed to +10V.

Enter the following speed settings if applicable:

- LS01 Leveling Speed
- LS02 High Speed
- LS03 Inspection Speed
- LS04 Correction Speed
- LS05 Intermediate Speed 1
- LS06 Intermediate Speed 2
- LS07 Intermediate Speed 3

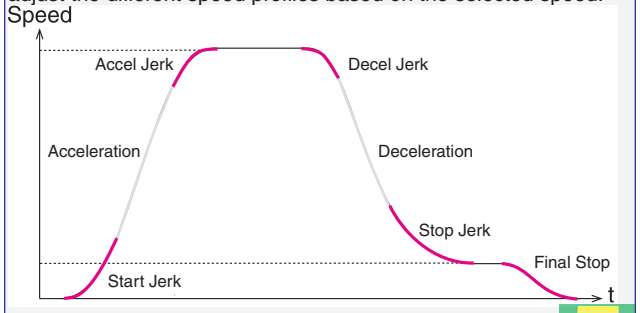
Note: The nomenclature of the speeds above are defined (as default) by KEB. However, the controller manufacturer may assign speeds differently (e.g. the controller manufacture may use Intermediate Speed 1 for High Speed). If the elevator does not move at the correct speed, verify which speed is selected and it's corresponding setting (Diag. screen #10). Also, verify whether the command speed and encoder speed match.

F2 – To begin with, use the KEB defaults for the profile adjustments.

The KEB LCD operator can approximate all relevant profile parameters depending on the desired aggressiveness of the application (i.e. soft, medium, or hard profile). The adjustments can be made with:

- LS15 High Speed Profile
- LS16 One Floor Profile (Intermediate Speeds 1, 2)
- LS17 Emergency Profile (Intermediate Speed 3)

F3 –Alternatively, if a user wants to customize the profile, they can adjust the different speed profiles based on the selected speed:



Speed Profile Parameters

	High Speed	Short Run Int. 1, 2	Emergency Int. 3	Inspection
Acceleration	LS20	LS30	LS40	LS50
Start Jerk	LS21	LS31	LS41	LS51
Accel Jerk	LS22	LS32	LS42	LS52
Deceleration	LS23	LS33	LS43	LS53
Decel Jerk	LS24	LS34	LS44	LS54
Stop Jerk	LS25	LS35	LS45	LS55
Final Stop	LS43-45			

(G) Motor Learn

G1 – Motor Learn
The Motor Learn function can be found under the Tune Parameters group from the Programming menu *(Home > Prog > Tune Parameters > LL01)*.
Begin the procedure by setting:

- LL01 Motor Tuning = Start

Follow the instructions on the LCD screen. The user is instructed to:

1. Disable the brake
2. If the speed is generated by the controller (Analog or Serial), then set external speed command to zero
3. Press and hold inspection (speed + enable inputs) until completed

The process should take 2-5 minutes and will emit a high pitched noise while the drive measures various motor parameters.

The drive will confirm a successful motor learn. If needed, reconnect the brake wire and return the controller command speed.

(H) Encoder Learn

H1 – Encoder Learn, *Induction Motors*
In applications with Induction Motors, the Encoder Synchronization function can be used to determine the correct A/B phasing of the encoder channels and whether the direction needs to be inverted for the correct direction of travel.
For Induction motors, the Encoder Synchronization can be adjusted at parameter LL07; Proceed to section H3 (IM only)

H2 – Encoder Learn, *PM motors*
When using PM motors, the encoder position/pole must be learned.

If at any time the physical relation between the motor shaft and encoder changes (i.e. encoder replaced, encoder slippage, etc.) the encoder position must be relearned.

There are 2 functions available to determine the encoder pole position with PM machines:
1. SPI (Stationary Pole Identification) – This process is preferred and can learn the encoder position without movement (i.e. with ropes + brake set).
OR
2. Encoder Pole Learn – Process requires sheave movement with little friction (i.e. unroped or balanced car) but can accurately determine encoder phasing.

1. SPI
To start the SPI Learn go to LL05 and follow the instructions on the LCD:

- LL05 - SPI ("Start")

The user will be prompted to:
1. Disable the brake
2. If the speed is generated by the controller (Analog or Serial), then set external speed command to zero
3. Press and hold inspection (speed + enable inputs) until finished

Upon successful learn, the pole position will be written to parameter LE06.
—> The drive will automatically go to step H3 to synchronize the encoder.

2. Encoder Pole Learn
This procedure requires relatively frictionless movement (i.e. unroped sheave or balanced load)
To begin the process, set Encoder Pole Learn to "START":

- LL06 - Encoder Pole Learn ("START")

The user will be prompted to:
1. Press and hold the inspection (direction + enable inputs) until finished

When the process is complete, the keypad will prompt the user to release the inspection command. The encoder position and A/B phasing information will be automatically written to parameters LL06 and LL03, respectively.
--> The drive will automatically go to step H3 to synchronize the encoder.

H3 – Encoder Synchronization
The Encoder Synchronization function can be used to determine the correct A/B phasing of the encoder channels and whether the direction needs to inverted for the correct direction of travel It should be done for both PM and IM applications. Begin the process by setting:

- LL07 - Encoder Synchronization to "START"

Then follow the directions on the keypad. The drive will iteratively run the elevator and swap the phasing and direction of the A/B channels as needed.

(I) Run The Motor

At this point, the drive should be set up far enough to run reasonably well on inspection speed. The user should run the elevator in both the up/down directions and monitor the current in the home/diagnostic screen.

- For a balanced car, the current should be reasonably low.
- For an empty car, the running current should be less than motor rated current in both directions.

If operation on inspection speed shows no issues, the next step is to run the elevator up to high speed.

Before this is done, there may be a few parameters which need adjustment:

- LC.30 - Maximum Torque (Default is 150%; Typical values are 200-250%)

Any time the motor data parameters are adjusted, the LC30 Maximum Torque will automatically re-calculate to 150%.

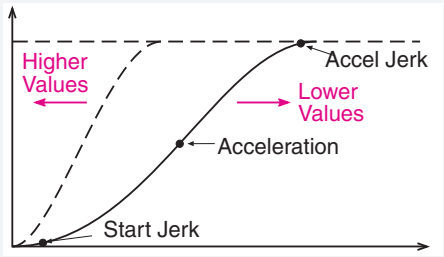
Run The Motor (at High Speed)

Now, the elevator should be able to run at high speed with no major issues. At this point, if the user is satisfied then no further adjustments may be needed to increase ride quality.

If further adjustments are needed, see **(J)** Advanced Adjustments.

(J) Advanced Adjustments (Password limited)

J1 - Adjusting Accel/Decel rates - See section F2 for more information.
In general, higher values result in a hard/fast profile, while lower values give softer, slower transitions.



J2 - Inertia Learn (FFTC)
Feed Forward Torque Control (FFTC) reduces the dependence on speed feedback from the motor by predicting what the elevator system will do and providing the required torque. It is recommended for optimal control of dynamic applications.

Process

1. Get the car running at contract speed over multiple floors
2. Balance the car and run on inspection to the middle of the hoistway. Monitor torque (Diag. screen #3) - the motor torque in the up and down direction should be equal but opposite in direction. If this is not the case, adjust the counterweights before proceeding.
3. Run the car at high speed. For buildings with 12 floors or less, run the car from top to bottom. For taller buildings, run between at least 10 floors from the middle of the hoist way (5 above, 5 below). Make sure this measurement is done from the middle of the hoistway to account for rope compensation. Make sure the car reaches high speed! If not, lower the speed such that the car reaches a stable speed for 2 seconds.
4. Begin the process by setting:

- LL10 - Inertia Learn ("START")

5. Follow the directions on the keypad. After four runs, the drive will automatically calculate the inertia based on the averages.

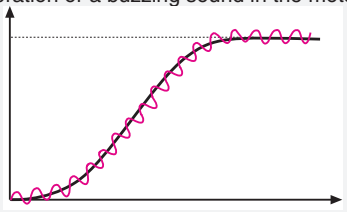
J3 - Gain Adjustment (in lieu of Inertia Learn)

Proportional Gain
The proportional gain maintains general control and stability over the entire speed range. In general, it provides the magnitude of response. The proportional gains are split up into the 3 values:

- LC03 - Acceleration and constant speed
- LC04 - Deceleration
- LC05 - Pretorque

Lower values (1000) may result in loose control and overshoot of the command speed as high speed is reached.

High values (10,000) can cause high frequency oscillation resulting in vibration or a buzzing sound in the motor.



Integral Gain
The integral gain is responsible for correcting long-term average error in speed as well as providing increased control and rigidity at lower speeds for starting and stopping. The integral gains are split into 3 values:

- LC08 - Acceleration and constant speed
- LC09 - Deceleration
- LC10 - Pretorque

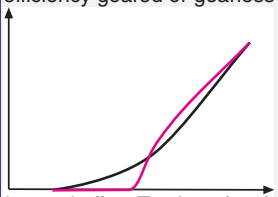
If the gains are too low, the actual speed will have difficulty tracking the command speed. The drive will not catch the load quickly or will have difficulty overcoming starting friction during takeoff

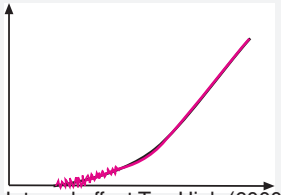
If the gains are too high there could be torque pulsations during accel, constant speed, or decel.

Integral Gain Offset
The integral offset gain values are effective only at low speeds. Values which are too low will cause the actual speed to lag the command speed. Values too high will cause vibration or steps at the final approach.

- LC11 - KI Offset Acceleration

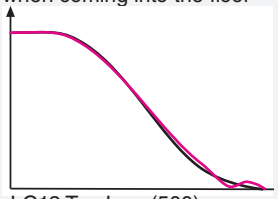
The offset acceleration gain will assist the motor in catching the load during starting - this setting is especially important for high efficiency geared or gearless applications.

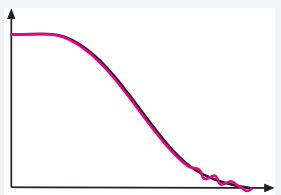

Integral offset Too Low (500)


Integral offset Too High (6000)

- LC12 - KI Offset Deceleration

The offset deceleration gain will assist the motor in tracking when coming into the floor


LC12 Too Low (500)

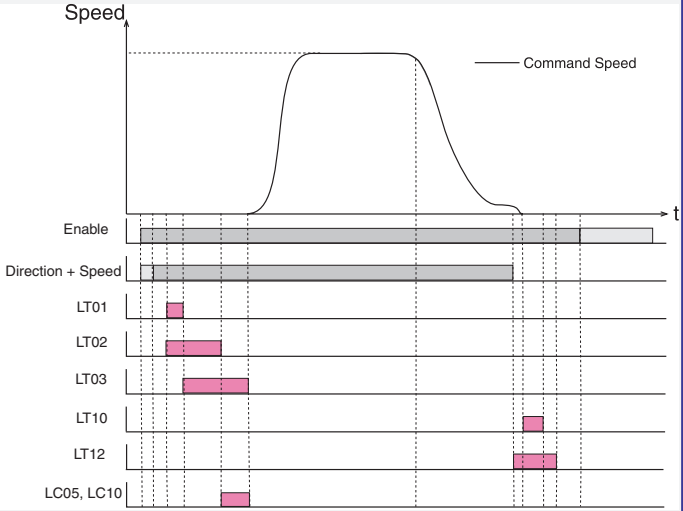

LC12 Too High (5000)

J4 - Pretorque Adjustment
The drive's internal pretorque is a feature which can be used to minimize the rollback which may occur at brake pick without the need for an external load weighing device. (Pretorque is available when LC01 = Closed Loop FOC or Closed Loop Synthetic Pretorque)

Adjust the brake spring tension, brake voltage, and brake timing first. Note that it is often advantageous to use a lower spring tension and lower brake pick voltage in order to provide a softer lifting of the brake.

Adjustments

- LT02 (Control Hold Off timer) - Should be set such that it expires briefly before the brake is picked.
- LT03 (Speed Start Delay) - Relates to the pretorque holding period before takeoff.
- LC05 (KP Speed Pretorque) - Gains active during LT03 pretorque period.
- LC10 (KI Speed Pretorque) - See LC05. Adjust higher for tighter control.



(K) Special Functions

- LL15 - Overspeed Test

Allows the drive to run at a higher speed than the programmed contract speed for a single run in order to perform overspeed or governor tests. The speed at which the overspeed test will perform is set in LL16.

- LL17 - Safety Release

The safety release function turns off the acceleration jerk rates and raises the maximum torque limit for one run in order to drive an elevator car off the safeties.

KEB America, Inc.
5100 Valley Industrial Blvd. S.
Shakopee, MN 55379
(p) - 952.224.1400
(e) - info@kebamerica.com

Troubleshooting & Errors - See section 7.0 of drive manual for complete listing

Error Over Voltage

Trip Voltage (460V drive) = 800VDC
Trip Voltage (230V drive) = 400VDC

Braking resistor should shunt at:
760VDC (460V drives)
380VDC (230V drives)

Check:
- Brake resistor connection
- Disconnect resistor - measure resistance
- Measure DC bus terminals (≈ 1.41x VAC_{IN})
- Proper mains grounding
- Is the Brake transistor functioning?

Error Under Voltage

Trip Voltage (460V drive) = 240VDC
Trip Voltage (230V drive) = 216VDC

Check:
- Input voltage and wiring
- Missing input phase
- Imbalanced input phases (not to exceed 2%)
- Proper mains grounding

Error Motor Protection

Excessive RMS motor current - according to LM08 (IM) and LM11(PM motor)

Causes:
- Excessive Current
- Incorrect motor data
- Incorrect encoder data
- High mechanical load/issues (friction)

Error Over Current

Can be monitored on Diag. screen #1 or DG06 or DG31

If error occurs instantly at the start of each run, the issue may be:
- Ground fault on motor leads
- Damaged or slow closing motor contactor
- Motor Failure
- Shorted output transistor in drive

If error is intermittent, the issue may be:
- Damaged or slow to close motor contactor
- Loose motor connections
- Electrical noise, faulty grounding
- Faulty cabling

Error Overheat Power Module

The heatsink temperature can be monitored on Diag. screen #7 or DG37.

Typically, the heatsink temperature should be below 65° C. Error trips at 90° C.

Causes:
- Insufficient cooling or high ambient temp.
  - Check operation of fans (LX06)
  - Make sure fans are not clogged
  - Increase airflow around inverter
- Faulty temperature sensor
  - Does error happen when drive is cool?

Error Overload

Time dependent overload - excessive current See section 2.7 of manual

Causes:
- Excessive Current
- Incorrect motor data
- Incorrect encoder data
- High mechanical load/issues (friction)
- Brake is not releasing at start of run

Error Low Speed Overload

Excessive current at low speed (< 3Hz)

Causes:
- Excessive Current
- High duty at low speeds
- Incorrect motor data
- Incorrect encoder data
- High mechanical load/issues (friction)
- Brake is not releasing at start of run

Error Low Motor Current

Low current during initial current check

Causes:
- One or more motor leads not connected
- Motor contactor not closing (or in time)
- Motor contactor contacts are damaged
- Motor windings are damaged

Error Overspeed

The internal overspeed limit is exceeded

Internal overspeed limit is 110% of contract speed (US06). This cannot be adjusted.

Causes:
- Incorrect machine data settings (LN01-03)
- Lack of motor control
  - Peak current reached (Diag. screen #1)
  - Max. torque might be too low (LC30)
  - Incorrect motor data (i.e. LM02 & LM04)
  - Incorrect encoder pole position
- Speed gains too high or too low
  - Unloaded motor might require low gains
- Modulation grade exceeds minimum
  - Monitor Diag. screen #2
  - Modulation should not exceed 100%
- Sudden, Excessive movement
  - Incorrect Motor data
  - Incorrect encoder data

Speed Following Error

The encoder speed deviates from the command speed by more than the amount set in LX14 (for more than 3 secs.)

Causes:
- Lack of control (torque/current limit)
- Speed gains set too low
- Mechanical issues / High friction
- Modulation grade exceeds maximum

Motor Noise

Vibration
- Increase sample rate of encoder (LE04)
- Reduced speed control gains
- Check if modulation grade is reached

Squealing/Grinding
- Check sample rate of encoder; 4-8ms typ.
- Check encoder multiplier (LE05)
- Verify motor data

"Clunk" at the end of the run
- Verify the drive enable is not being dropped prematurely while drive is still outputting torque to the motor (i.e. enable is dropped before the speed and direction are dropped)
- Check fault log - Is "Enable Loss Detected" error present?

Torque Limit Being Reached

Is LED1 red? (CAN version only). If so, torque limit could be reached.

Causes:
- LC30 is too low
- Incorrect motor data
- Incorrect encoder data
- Incorrect gains
- Modulation grade being reached

Selected Parameters - See section 8.1 of drive manual for complete listing

The ability to view/write parameters is dictated by the user access level (Home > Prog > Pass (F2)) - Contact the controller OEM for more information

LE - Encoder Parameters

Param.	Name	Value
LE01	Encoder 1 Interface	
LE02	Encoder 1 Pulse Number	
LE03	Swap Encoder 1 Channels	
LE04	Encoder 1 Sample Rate	
LE06	Encoder 1 Pole Position	

LM - Motor Parameters

Param.	Name	Value
LM01	Motor Power	
LM02	Motor Speed	
LM03	Motor Current	
LM04	Motor Frequency	
LM05	Motor Voltage	
LM06	Motor Power Factor	
LM07	Motor Torque	
LM09	Elec. Motor Protection	

LN - Machine Parameters

Param.	Name	Value
LN01	Traction Sheave Diameter	
LN02	Gear Reduction Ratio	
LN03	Roping Ratio	

LS - Speed Parameters

Param.	Name	Value
LS01	Leveling Speed	
LS02	High Speed	
LS03	Inspection Speed	
LS04	Correction Speed	
LS05	Intermediate Speed 1	
LS06	Intermediate Speed 2	
LS07	Intermediate Speed 3	
LS15	High Speed Profile	
LS16	One Floor Profile	
LS17	Emergency Profile	

LL - Tune Parameters

Param.	Name	Value
LL01	Motor Tuning	
LL05	SPI	
LL06	Encoder Pole Position Learn	
LL07	Encoder Synch.	
LL10	Inertia Learn	
LL15	Overspeed Test	
LL16	Overspeed Test Speed	
LL17	Safety Release	

LC - Control Settings

Param.	Name	Value
LC01	Control Mode	
LC02	Speed Gain Optimization	
LC03	KP Speed Accel	
LC04	KP Speed Decel	
LC05	KP Speed Pre-torque	
LC08	KI Speed Accel	
LC09	KI Speed Decel	
LC10	KI Speed Pre-torque	
LC11	KI Speed Offset Accel	
LC12	KI Speed Offset Decel	
LC30	Maximum Torque	

LT - Timer Parameters

Param.	Name	Value
LT01	Brake Release Delay	
LT02	Brake Hold Off	
LT03	Speed Start Delay	
LT10	Brake Drop Delay	

LX - Special Parameters

Param.	Name	Value
LX02	Switching Frequency	
LX06	Fan Function Test	
LX08	Phase Current Check	
LX13	Speed Following Error	
LX14	Speed Difference	

CH - Configuration Handling

Param.	Name	Value
CH01	Default Parameters Factory Default (OEM)	
CH02	Save (to flash or SD card) Write to drive	
CH03	Restore (from flash or Card)	